UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**
JUNE 1946

EROSION CONTROL PRACTICES DIVISION

On-Location Educational Use of Research Work - H. B. Atkinson, LaCrosse, Wisconsin.-"Tours of the Station for this month included the following:

June 3 - Group of 20 high school students from New Ulm, Minnesota.
June 5 - Group of 60 farmers from eastern Fillmore County, Minnesota.
June 8 - Approximately 50 Soil Conservation District Supervisors from Minnesota.
June 11 - Group of 45 farmers from the Upper Zumbro District, Minnesota.
June 12 - Group of 60 farmers from western Fillmore County, Minnesota.
June 14 - Soil Conservation Service personnel from Work Groups 1 and 2 of Wisconsin.
June 25 - LaCrosse County, Wisconsin, AAA Committeemen visited station.
June 30 - Group of 30 farmers from Plum Valley watershed, Wisconsin."

Stubble-Mulch and Wheat Production - C. J. Whitfield, Amarillo, Texas.-"The earliest wheat harvest in the history of the Plains occurred this year. Combining was started on June 10 and completed June 21. Harvest in this area usually begins from June 20 to 25. The early harvest was mainly due to a warm spring and severe drought. Wheat yields were low but were from one to two bushels higher than expected. Clover mite damage occurred on some fields which also reduced the wheat yields. Precipitation from July 1, 1945 to June 1, 1946 was 11.47 inches as compared to 15.78 inches, the 7-year average. Only 2.13 inches of effective moisture was received from October 1 to June 1, the growing season for wheat. The wheat was mainly made from moisture stored in August and September 1945. The high yield in the regular series of fields and plots was on fallow prepared by stubble-mulch tillage with 30-inch sweeps and was 15.4 bushels per acre. The average of all fallow fields and plots in an alternate wheat fallow system was 12.6 bushels per acre. The average of wheat on fallow in a sorghum-fallow-wheat rotation was 8.2 bushels per acre. Where wheat was seeded after wheat, the average yield was 5.6 bushels per acre. The high yield was on special 3-year fallow plots and was 19.7 bushels per acre. These plots were fallowed three years by subsurface tillage and had enough cover to prevent blowing.

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**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"Under the extremely dry conditions, the subsurface implements gave much higher wheat yields than the conventional method of onewaying. The 30-inch sweeps machine modified on the station, the Noble blade, and the Hoeme cultivator gave the best results. The Hoeme cultivator is becoming popular in this area and in this first year's test gave satisfactory results. It covers more of the residue than the 30-inch sweep machine or Noble blade but leaves from one-half to two-thirds of the residue near or on the surface. Yields from the stubble-mulch plots are as follows:

Tillage Study - Average of Four Plots

Tillage	Grain Yield Bushels per Acre
Noble Blade - continuous wheat	6.1
30-inch Sweeps - continuous wheat	5.9
Oneway Plow - continuous wheat	2.6
Moldboard Plow - continuous wheat	1.8
Stubble burned and onewayed - continuous wheat	1.1
Delayed fallow - wheat on fallow - 30-inch sweeps	15.4*
Stubble fallow - wheat on fallow - 30-inch sweeps	13.9**
Clean fallow - wheat on fallow - oneway	8.5**

* Fallow begins about April 1.
** Fallow begins immediately after harvest.

"The high yield on continuous wheat was with land prepared with a Noble blade. The 30-inch sweeps ranked second. Both implements do a good job of subsurface tillage. It is interesting to note that stubble burned and onewayed gave the low yield, with moldboard plow second low. Much interest is developing in this area in subsurface tillage. The shortage of machinery is holding up the spread of this work."

Mulch Farming - T. C. Peele, Clemson, South Carolina.-"The most practical procedure for mulch farming that we have used up to the present time is outlined below:

1. Disk the soil twice with a heavy tandem disk harrow having notched disks with the disk harrow heavily weighted with rocks or some other means. The disks should be operated at about half angle and the tractor driven slowly although this can be varied according to the quantity of plant residue and soil conditions. With heavy residue and hard, dry, clay soil the disks can be operated at full angle without incorporating an excessive amount of residue. On sandy soils it would be necessary to operate the tractor at slower speed and give the disks less angle to prevent incorporating excessive amounts of residue. The disk-harrow is a very versatile tool and there is an opportunity for the operator to use considerable judgement in its method of operation to secure the desired result. The object of the disking operation is to loosen the soil to a depth of 2 to 4 inches, chop the residue on the surface and kill any plant growth without incorporating any more of it than necessary.

2. The second operation consists of ripping the soil at 42" intervals using middlebuster shares with moldboards removed, preceded by rolling coulters and followed by reversed disk-hillers set to push the plant litter out of the furrow without pushing any more soil into the areas between the furrows than necessary. The disk-hillers are set to run very shallow. The two middlebuster shares used on a two row tractor for this operation are mounted on the front tool bar with gage wheels attached to the tool bar to insure operation at the proper depth. The object of this operation is to prepare a loose, clean seed bed in a moderately deep furrow for planting corn.

3. The third operation consists of planting the corn and applying fertilizer in the drill using standard planting equipment on a two row tractor.

4. The corn is given two or three cultivations using standard sweeps on standard cultivating equipment with the sweeps set to run rather flat.

"We believe that this method or some slight modification of it can be used satisfactorily by farmers for mulch farming practices with corn, and we are ready to recommend that it be tested on a field trial basis. We plan to try to get some field trials with much farming using this method started in several locations next year. In the meantime research on cultural implements and procedures for improving our mulch farming technique will be continued."

Handling Heavy Straw Residue - Hugh C. McKay, St. Anthony, Idaho.- "Considerable experience was gained this year in handling heavy straw residues. The tillage plots had from 5000 to 6000 pounds of residue at time of initial tillage. In preparatory tillage it was found that one disking with the tandem double disk was worse than no disking at all. On the plots disked twice no difficulty was encountered with any of the initial tillage implements. The extra disking seemed to cut the stubble up into small enough pieces so that it would not catch on the beams.

"The only implement that would handle the heavy residue when no preparatory tillage was given was the Dempster sweep machine with the three 30-inch sweeps. This machine did a very nice job this year. The other implements fell in the following order with the first one giving the least trouble, with the last one being almost impossible to work in the heavy stubble: the modified moldboard, one-way disk plow and the Calkins rod weeder with shovel attachments."

Subsurface Cultivation - Torlief S. Aasheim, Bozeman, Montana.-"The Graham-Hoeme cultivator which has been sold in large numbers this year was observed in operation at several locations. This implement does a fair job of leaving residues on the surface when it is used exclusively in cultivating summer fallow. However, some difficulty has been experienced with the machine. The wide sweeps are very readily broken in stony ground, and where trash is heavy it does not have sufficient clearance. It is my opinion that the Noble cultivator is still the best implement to use in most areas of Montana where a stubble mulch is desired. It is sturdy, does a good job of killing weeds and is unsurpassed in leaving a good protective mulch."

Results of Soil and Water Loss in Successive Storms - George W. Hood, Batesville, Arkansas.-"Two storms that occurred close together during May now have passed through the Laboratory and the Table 1 shows the results of the damage. The data has been computed on both the percentage of water and the inches of rain lost, as well as the total soil loss per acre.

Table 1.-Soil and Water Loss during the Storms of May 23, - 25 and 31, 1946

Practices	Tons of Soil Lost		Percent of Runoff		Inches of Rain Lost	
	Rainfall		Rainfall		Rainfall	
	5.40"	1.68"	5.40"	1.68"	5.40"	1.68"
Continuous Cotton w/slope 90' Rows	10.68	3.83	10.05	40.65	.54	.68
Continuous Cotton w/slope 200' Rows	29.21	10.97	5.99	34.22	.32	.57
Continuous Cotton on Contour	15.17	.51	10.73	45.47	.57	.76
Cotton in 3 Year Rotation on Contour	5.70	2.35	10.13	38.45	.54	.64
Corn in 3 Year Rotation on Contour	9.69	4.72	9.59	38.21	.51	.64
Oats in 3 Year Rotation on Contour	1.05	.16	11.31	41.87	.61	.70
Strip Crop	1.43	1.31	2.42	11.99	.13	.20

"The condition of the soil on all the plots will throw some light on the results. The ground had been prepared and planted when the first rain occurred. Both the cotton and the corn had had one cultivation, the corn a deep cultivation with a good furrow between each row. The cotton had a shallow cultivation with no well defined furrows between the rows. The oats had not yet been cut, but was ripening fast."

Erosion Control on Lima Bean Fields - Maurice Donnelly, Riverside, California.-"Two interesting points concerning the experiments on lima-bean fields are:

1. We have been comparing the erosion-control usefulness of contour ripping versus contour subsoiling. The two types of tillage are much alike and are performed by dragging a heavy chisel or subsoil blade through the soil along a contour line. In ripping, the depth of penetration of the soil ranges from 7 to 10 inches, whereas, in subsoiling depths of from 12 to 16 inches are reached. Since the power requirements for subsoiling are much higher than those for ripping, operators wish to know whether the extra cost is justified.

"During the December 1945 storm, soil was moved from ripped fields at a rate (estimated) of 25 tons per acre. Subsoiled fields showed no soil removal. The subsoiled fields also were in such condition at the end of the storm that they could have absorbed considerable additional rainfall without damage.

2. In the 2-year rotation of lima beans and grain hay, a summer weed comes into the grain-hay fields after hay harvest. The question is--should this weed be destroyed by tillage during summer? If it is destroyed, much of the hay stubble is necessarily turned under. By leaving the weed dry up, as it does in the fall, additional organic residue is at the surface to control winter rains. On hay stubble fields where this weed had not been turned under and where light subsoiling was done in the fall, rainfall in the December 1945 storm was totally absorbed and a remarkably high infiltration capacity still existed on these fields at the close of the storm.

"Unless an unforeseen biotic effect develops (such as increase in wire worms), I consider it better to leave the weed untouched during the summer and to utilize it as stubble mulch during the winter."

Orchard Erosion Control - J. C. Moore, Auburn, Alabama.-"A group of technicians, including representatives from Soil Conservation Service, Extension Service and Farm Security Administration, along with a group of farmers from one of the leading fruit producing sections of Alabama visited our project on June 18, 1946, to observe and discuss the needs for erosion control in orchards. Several observations were made:

1. Lespedeza sericea sod, where the sericea is cut three times per year and left on the ground undisturbed, was doing a fine job of controlling erosion.

2. Bur clover that has had natural reseeding for three years, cut twice during the summer to destroy weeds, was doing a fine job of controlling erosion.

3. Clean cultivated plots showed less annual growth and the fruit was smaller in size. (All treatments were thinned by hand picking.)

4. Increased annual growth was noted on sodded areas along with increased size of fruits.

5. Lespedeza sericea would be recommended for 5% slope and above. Bur clover or some early seeding legume such as grandiflora vetch would be recommended for slopes below 5%.

"Much interest was shown by the group and they were in one accord as to the need of erosion control in orchards."

Field Brome Looks Good as a Cherry Orchard Cover - E. A. Carleton, Geneva, New York.-"Measurements of total dry matter of Bromus arvensis (field brome) as a surface cover in the cherry orchard were made June 26. When the fruit began to color, this grass was disced over once to reduce competition, to break down the high grass as an obstruction to harvesting and to maintain the cover as a mulch but permitting a partial growth for natural reseeding in August. The area was originally seeded August 31, 1944. In the Spring (1945 and 1946), nitrogen as sulfate of ammonia was applied, at rates shown in the table below, by sowing broadcast to influence growth of grass cover.

Production of Mulching Material Within Orchard Area

Treatment per tree area 22' x 22' (90 trees an acre) Pounds sulfate ammonia	Dry matter Bromus arvensis Pounds an acre
None	3855
1.5	4405
3.0	5845
6.0	6100

"The effort in this experiment is to maintain a good cover to control soil and water losses while manipulating the water demand of the grass cover to reduce competition with the tree. This grass is a shallow-rooted annual. It gives an excellent winter cover, produces large quantities of seed, but needs nitrogen to maintain growth."

Brush Suppression - Dwight D. Smith, Columbia, Missouri.-"Observations were made on the effect of Weedone on control of brush on the No. 4 ditch of the Little River Drainage District in Cape Girardeau County, Missouri on June 4. Willow, sumac, and cottonwood sprouts that were staked last summer at the time of application were dead. Trumpet vine, pecan and ash sprouts had leafed this spring but appeared to be dying. There were thriving willow and hickory sprouts which may have sprouted after the poison had been applied. The results are encouraging although a complete killing of brush sprouts was not secured."

Dust Bowl Thrust - H. H. Finnell, Amarillo, Texas.-"I have been trying to make the most of every opportunity which presents itself to give fair warning of the increasing seriousness of the dust bowl threat. Digging more deeply into the historical facts of the previous dust bowl period, the following interesting slant on the nature of the problem has been revealed. During the 1930's, 59 percent of the dust came as a result of farming land unsuited to cultivation. Only 2.3 percent of it came from the neglect of safe practices on good types of soil. The rest of it, something over 38 per cent, came from second grade land which could have been farmed safely and successfully if proper methods of wind erosion prevention had been used. Inasmuch as the oncoming threat involves the further extension of sod breaking into the marginal zone than did the plow-up of the 1920's, perhaps an even greater proportion of the dust storms to come will be the result of cultivating inferior types of soil. Hence, the heaviest end of dust storm control rests in keeping greenhorns off the low-grade land. It is my belief from recent observations that better care by farmers will be taken of the Class II, III, and IV lands in the established farming areas than before.

"A fact which I believe shows the need for perpetual education and organized guardianship of the land, is the fact that fields blown out, abandoned and reclaimed with Government assistance less than 10 years ago are now being again put back into cultivation."

Pasture Renovation - O. R. Neal, New Brunswick, New Jersey.-"In the fall of 1945 we cooperated with the Farm Crops Department in some pasture renovation work on two dairy farms in Northern New Jersey. The land slopes were steep varying from 25 to 40 percent. Vegetative cover present was poor. Cultivation was done with a disk harrow and a spring-tooth harrow. These implements turn up clumps of the old sod and leave the land in a rough condition. Observations this past spring indicated that erosion losses during the establishment of the seedings were little greater, if any, than from untreated areas where the vegetation was poor. Preliminary indications are that these pasture areas can be renovated, by using rough cultivation methods, without exposing the areas to severe erosion losses."

Pitted Pastures - O. K. Barnes, Laramie, Wyoming.-"The pitted native range pastures continue to show a striking advantage in volume of feed as compared to non-treated native range. At the present time, the pitted pastures are carrying 66 per cent more sheep per acre."

Earthworm Studies Suggest a Modification in Continuous Soybean Cropping Methods - Henry Hopp, Beltsville, Maryland.-"Earthworm measurements at the University of Maryland have been made monthly from February to June on drilled soybean plots handled under different cropping methods. The crop treatments, water-stable soil aggregation, and results of the earthworm counts are as follows:

Treatment	Water-stable soil aggregates in April (percent)	Earthworms (thousands per acre) Feb.	Mar.	Apr.	May	June	Aver.
1. Land plowed and planted to soybeans in early May; harvested for hay; ryegrass winter cover	31	112	83	42	62	56	71
2. Land plowed and planted to soybeans in May; combined for grain; combine residue disked in for cheat grass winter cover	33	115	125	146	187	277	170
3. Land plowed and planted to soybeans in May; combined for grain; combined residue disked in for rye winter cover	28	115	250	125	104	166	152
4. Land plowed and planted to soybeans in May; combined for grain; combine residue left as surface mulch until following May	34	160	506	458	145	416	337
5. Land plowed and planted to soybeans and some sorghum in late June; harvested for silage; disked in fall for winter barley; manured in spring	71	572	187	478	811	1220	654

"The results indicate the relatively unfavorable soil structure associated with ordinary methods of growing soybeans (as treatments 1, 2, and 3), and suggest that soil structure may be maintained if the soybeans are preceded by a winter barley crop (as treatment 5). The maintenance of earthworms under this cropping plan appears to be associated with certain effects on their life-cycle."

Studies of Aggregation - C. S. Slater, College Park, Maryland.-"An aggregate analysis as ordinarily determined measures the total amount of water stable aggregates in a soil sample, reflects the stability of particles of mixed sizes and also, the degree of pulverization that has been caused by tillage or sample preparation. The data that result from the measurement of this complex are not always applicable to the determination of simpler functions or relationships.

"Recently we have determined aggregate stability by a method that is a "hybrid" between an ordinary aggregate analysis and McCalla's drop test. Lumps of dry soil approximately 4 mm. in diameter are sieved out of the soil by using a 5 mm. and a 3 mm. sieve. Twenty-five grams of these lumps are distributed on a sieve nest of 2 sieves of 10 and 35 mesh and run on the aggregate analysis machine for 2 minutes. The soil that remains on the sieves is dried and weighed and a gravel correction is made where necessary. The above test gave a good differentiation among treatments on a moderately aggregated silt loam soil, where the ordinary aggregate analysis had failed almost completely.

"In order to differentiate the effect of treatments on a poorly aggregated loamy sand it was necessary to use 35 and 70 mesh sieves for the nest. There just wasn't any lumps in this particular soil."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"The total rainfall for the month ranged from 6 to 8 inches over the Government area. The greatest amount in a single storm occurred during the night of June 16-17 when as much as 4.39 inches was recorded. The maximum 5, 10, 15, 30, and 60-minute rainfall intensities amounted to 4.8, 4.8, 4.8, 4.0, and 3.2 inches per hour. The 30-minute rain has a probable recurrence of once in 50 years and that for 60 minutes is somewhat above 100 years (when compared to the Columbus U.S.W.B. records).

"This high intensity of rainfall coupled with the high soil moisture and sealed soil surface in cornfields (3/4 inch of rain fell 3 days before this storm) combined to produce flood peaks on all but the smallest areas greater than heretofore recorded. Flood peak values for a number of selected watersheds is given in the following table. It is to be noted that the small contoured corn watershed (No. 103) produced slightly less runoff than the straight-row watershed (No. 110) yet the soil loss is widely different. A similar comparison can be made between the strip-cropped watershed (No. 185) and the straight-row watershed (No. 192).

"The long continuous period of high intensity rainfall produced a flood peak on the 303-acre watershed twice as high as previously recorded. Prior to this storm there was one of about the same rainfall intensity; yet its flood peak was only one-third that of the June 16-17 storm.

"Had this storm occurred before first cultivation, much of the straight-row corn would have been washed out. As it was, the corn had been cultivated once and the runoff water flowed down the cultivator tracks between the corn rows. In some places rills 6 inches deep developed between the rows. Here subsoil was exposed. There was very little of such erosion evident in the contoured corn rows.

"It should be pointed out that in the straight-row watershed, some of the rows are on the contour, some have little slope, and others are up and down hill. This is how straight-row farming appears in natural farm fields.

"It is also emphasized that this was a severe storm - one where conservation practices might be expected to fail. There was soil loss on the contour strip-cropped field - about 4 tons per acre of corn as compared with 11 tons per acre of corn on the straight row field. More than 4 tons of soil moved from each acre of corn on the strip-cropped field as evidenced by the numerous deposits of soil in each sod strip below the corn strips."

Storm of June 16, 1946

Watershed No.	Drainage area	Land use	Total Rain	Total Runoff	Flood peak	Soil loss
	acres		Inches	Inches	Inches per hour	Tons per acre
103	0.65	Corn-contour	3.65	1.78	3.45	3.9
110	1.27	Corn-straight	3.65	2.13	4.17	17.0
192	7.86	" "	3.56	2.15	4.60	11.2
185	6.87	Corn-meadow strips	3.56	1.42	3.35	2.0
115	1.61	Wheat-prevailing	3.61	1.32	2.43	.06
123	1.37	Wheat-improved	3.61	1.48	1.91	.02
109	1.69	" "	3.40	.47	1.41	.02
130	1.63	Meadow-good	3.05	.69	1.45	T
135	2.69	Pasture	3.35	.57	1.43	T
131	2.21	Woods	3.05	.09	.17	T
169	29.0	Mixed-improved	3.56	-	2.08	-
172	43.6	Woods	2.97	-	.72	-
177	75.6	Mixed-improved	3.05	-	1.40	-
183	74.2	" -prevailing	4.17	-	2.58	-
196	303	" "	4.17	2.10	2.49	-
5	349	" -improved	2.80	-	.23	-

Hydrologic Studies - John A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"During June precipitation totaled 2.69 inches at the Meteorological station, which is 2.32 inches below the 8-year average at this station, and 1.2 inches below the 50-year average at Hastings. A rain of 1.34 inches on June 19, preceded by a rain of 0.73 inch on June 18, was the first storm this year to produce runoff. However, the amounts were small because of the low intensities and the dry soil conditions.

"Mr. I. W. Bauer, Associate Hydraulic Engineer, presented a paper entitled 'The Effects of Land-Use on Water Conservation and Crop Yields', at the American Society of Agricultural Engineers' meeting in St. Louis, Missouri, June 26, 1946."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"Runoff was analyzed for five storms in June. There were appreciable losses from the storms of June 18, 19, and 20. Concentrations of total solids from the conservation treated watersheds were consistently less than from those under pevailing treatment. Concentrations of solids in runoff from soybeans were very much less than from corn and the differences with respect to treatment were small for the beans. The beans followed corn in

the rotation and the corn stalks had been disced down and provided considerable mulch in the surface 0-3 of soil. The beans were seeded during the first month of June and had not been cultivated.

"A total loss of the hay crop was sustained on the conservation treated watersheds due to contamination of 'sour dock.' It appears that this came about through manure top dressing of the preceding wheat. Hay was fed which had been seriously delayed in harvest and contained considerable mature dock. Hay harvests on the watersheds have been undesirably late every year. This has resulted in unnecessary maturing of weeds and increasing 'foulness' of the ground; also reduced feed value of the hay. The crop on the conservation meadow watersheds was mowed and windrowed to be removed and destroyed. However, it is doubtful that this was done early enough to prevent a thorough reseeding of the dock and it has not been possible to get the material removed. There is no alternative at this time to burning it in the windrows to get it off the watersheds and secure a second growth of meadow to be plowed under."

Hydrologic Studies - R. G. White, East Lansing, Michigan.- "There were two periods of runoff at Watershed 'A' (corn), but no runoff at Watershed 'B' (brome-alfalfa), nor at the wooded watershed. On the evening of June 17, rainfall measuring 1.13 inches caused runoff from Watershed 'A' measuring 0.2280 inch. This storm had been preceded by about 12 hours by a rainfall totaling 0.38 inch, which caused no runoff. Twelve minutes after the start of this storm, rainfall reached its high peak intensity of 5.40 inches per hour for 1 minute and caused a peak rate of runoff of 0.60 inch per hour. Approximately 2 hours later, after an additional 0.33 inch of rain had fallen, a peak rainfall intensity of 3.60 inches per hour caused a peak rate of runoff of 1.01 inches per hour.

"The second storm occurred shortly after midnight on June 20 when 0.56 inch of rain fell over a period of 1-1/2 hours. A 7-minute peak rainfall intensity of 2.00 to 2.10 inches per hour caused a peak rate of runoff of 0.78 inch per hour. Twenty-two minutes later, a 1 minute peak rainfall intensity of 2.40 inches per hour caused a peak rate of runoff of 0.49 inch per hour.

"Both the storms of June 17 and June 20 caused considerable soil loss from corn."

Runoff Studies - V. D. Young, Fayetteville, Arkansas.-"The rainfall-runoff relationship of the largest storms occurring on the watersheds near Bentonville, Ark.; Muskogee, Okla.; and Garland, Tex., during the period May 28th to June 30th, are given on pages 12, 13, and 14. Also given is the duration of the storm, maximum intensity for selected time intervals, maximum peak rates of runoff corrected for pondage, and cover and tillage notes.

Table 1.--Bentonville, Arkansas
Storm of June 26, 1946

Watershed	Rainfall	Storm Period	Max. rainfall intensity for selected time intervals (Inches)					Max. Peak Rate	Runoff	Runoff Percent of Rainfall	Cover
			5 Min.	10 Min.	15 Min.	20 Min.	30 Min.				
	Inches	Min.						Ins/hr.	Inches		
W-I (Sears) 10.03 Acres	1.42	154	0.25	0.46	0.66	0.86	1.14	1.5534	0.7306	51.8	Oat cover and fair cover of lespedeza
W-II (Henderson) 9.34 Acres	2.60	90	.44	.86	1.26	1.62	2.16	2.1360	.7978	30.7	Lespedeza, grass, and weeds cover with scattered brush
W-III (Henderson) 14.25 Acres	2.65	93	.46	.90	1.32	1.67	2.15	1.3781	.7018	26.5	Oats, lespedeza, grass. and weeds cover.
W-IV (Greer) 24.0 Acres	1.06	264	.27	.41	.55	.71	.79	0	0	0	Wooded
W-V (Mayfield) 19.4 Acres	1.10	84	.22	.40	.56	.73	.93	.1181	.0682	6.2	Clean cultivated corn, spring oats
W-VI (Rife) 10.75 Acres	2.68	130	.46	.84	1.21	1.51	1.90	.7721	1.0321	38.5	Meadow cover of grass and lespedeza

Table 2.--Muskogee, Oklahoma
Storm of June 26, 1946

Watershed	Rainfall	Storm Period	Max. Rainfall Intensity for selected time intervals (Inches)					Max. Peak rate	Runoff	Runoff Percent of Rainfall	Cover
			5 Min.	10 Min.	15 Min.	20 Min.	30 Min.				
	Inches	Min.						Ins./hr.	Inches		
W-I (Stebbins) 14.49 Acres	3.03	370	0.58	0.96	1.29	1.55	1.74	3.3399	0.7500	24.75	Alfalfa, mostly corn.
W-II (Stone) 65.36 Acres	3.57	448	.52	.86	1.17	1.46	2.04	1.1453	.2950	8.26	Corn, weeds, and grasses. Pasture.
W-III (Reid) 21.85 Acres	3.26	578	.40	.74	1.10	1.40	1.73	2.1379	1.0816	33.18	Lespedeza pasture. 20 cattle grazing.
W-IV (Trumbo) 24.87 Acres	2.32	402	.35	.64	.90	1.09	1.23	.0102	.0290	1.25	Pasture and native meadow.

Table 3.--Garland, Texas
Storm of May 28-29
" 29-30
1946

Watershed	Rainfall	Storm Period	Max. rainfall intensity for selected time intervals (Inches) 5 Min.	10 Min.	15 Min.	20 Min.	30 Min.	Max. Peak Rate	Runoff	Runoff Percent of Rainfall	Cover
	Inches	Min.						Ins./hr.	Inches		
W-I (Guthrie)	2.61	404	0.24	0.43	0.53	0.67	0.95	0.2602	0.6367	9.97	Corn, narrow strip of cotton and oats.
25 Acres	3.17	332	.72	1.21	1.45	1.46	1.51	2.0311	1.9093	57.51	
W-III (Oats)	2.20	332	.28	.44	.58	.65	.76	.6999	1.0433	47.42	Meadow and small top area in corn which was approx. 5 ft. tall.
10.4 Acres	2.86	290	.60	.85	1.05	1.10	1.11	4.3293	2.8189	98.56	
W-IV (Hill)	2.28	628	.24	.40	.55	.65	.75	1.9039	1.2224	53.61	Pasture, cover of weeds and grass, and in corn.
16.2 Acres	2.65	328	.70	.95	1.02	1.04	1.05	7.4199	2.1653	81.71	
W-V (Davis)	3.09	400	.30	.43	.63	.78	1.08	2.3735	2.5279	81.81	East 9.3 acres in corn - center strip in peas, and several acres in cotton.
14.5 Acres	2.74	300	.61	1.17	1.40	1.57	1.72	8.6868	3.9994	145.96	

"The storm on the Bentonville watersheds had a frequency of 2 years or less for watersheds W-I, W-IV and W-V, while on Watersheds W-II, W-III, and W-VI the storm frequency varied between 10 and 25 years with the highest intensity recorded on Watershed W-III. The highest percentage of runoff occurred from the cultivated area W-I, with no runoff from the wooded area.

"Two heavy storms occurred on the Garland, Tex., watersheds May 28-29 and 29-30. The second storm followed the first by a few hours and produced exceptionally high peak rates of runoff. The intensity of this latter storm was double or better than the first storm. These data indicate that the Davis Farm Watershed must have received runoff from a watershed adjacent to it as the total runoff for the two storms exceeds the total rainfall by 0.507 inch when using Standard gage measurements and 0.627 inch if the totals of the recording gage records are used.

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"At the laboratory the main effort was directed towards the completion of structures necessary for the testing of the large field channels (FC1 and FC2). Completed are the gates and approaches to channels FC1 and FC2 and also the installation of the sockets for the profiler apparatus for these channels. Maintenance work at the laboratory consisted principally of mowing the grounds and supply canals.

"The initial draft of the Handbook of Channel Design, Region 4 was completed including the final drafting of 21 diagrams which accompany the text.

"A non-technical paper entitled 'Vegetation for the Protection of Conservation Waterways' was prepared for presentation to the Conservation Workshop conducted by the school of education of Oklahoma A & M College."

Hydraulic Studies - A. W. Marsh, Corvallis, Oregon.-"At the Malheur Station 40 plots were staked out on the previously located slick spots. These are 12' x 12' plots and are placed in whatever position is necessary to properly fit the slick spots. Soil samples were taken to 4 feet from each plot. The manure was hauled to those plots which are to receive it and disked three times. Sustained high winds toward the end of the month prevented application of the mineral treatments.

"A fair quantity of rough lumber was obtained with which to construct a flume for water delivery and control on the hillside non-saline plots. This flume was built and installed for the third irrigation, just completed. The elimination of weir and control box washouts well repaid, in just one irrigation, the time spent in flume construction. The manured plots again wet more quickly and thoroughly than the other plots, with the 12-inch corrugations performing nearly as well. The surface cracking that takes place as the soil drys between irrigations proved to be a

source of annoyance on the 12-inch corrugations. The cracks extended across the middles from one corrugation to another frequently short-circuiting the water at the beginning of the irrigation and causing it to run down the wrong corrugation. This does not occur with 24-inch spacings. This cracking may cease to bother when a sod becomes established."

Hydraulic Studies - Vito A. Vanoni, California Institute of Technology, Pasadena, California.-"A first draft of a report covering the tests of Lake Coffee Mill spillways Plans IV and V was completed.

"In analyzing the data for the report, it became increasingly obvious that neither of these spillways would operate satisfactorily over the complete range of tailwater elevations to be expected. At the lowest tailwater elevations, the jump had a tendency to be swept out of the stilling basin. At the highest elevation, the jump became unstable, and the flow in the stilling basin was very disturbed and caused a number of high intensity jets to occur."

Sedimentation Studies - L. C. Gottschalk, Washington, D. C.-"The resurvey of Lake Decatur, Decatur, Illinois, was completed June 22. Preliminary calculations indicate that the rate of silting of this reservoir was slightly greater during the past 10 years than it was during the first 14 years of the 24-year period that this reservoir has been in operation. Loss of storage capacity due to sedimentation since the reservoir was put in operation in 1922 has amounted to 26.2 percent of the original capacity of the reservoir."

Sediment Studies - Vito A. Vanoni, Cooperative Laboratory, California Institute of Technology, Pasadena, California.-"Experiments were made in the 33-inch flume to study the mechanics of sediment suspension with a view to establishing laws for the effects of the sediment on the flow, which may be used to ultimately establish the universal sediment transportation law."

Drainage Studies - Lee D. Dumm, Athens, Georgia.-"Approximately 310 feet of additional drainage ditch was completed by blasting and greatly improved the drainage of a very wet spot in the project area.

"Fence posts were set around both the irrigated and non-irrigated pasture areas and is ready to have the barb-wire installed as soon as time permits.

"The ditch in which the transite pipe for the main supply line is to be installed was completed and is ready for this installation when the pipe is received."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"During the latter part of the month the largest portable type of overhead irrigation was checked. This portable unit has motor, pump, and riser, mounted on two wheels and is moved by a small tractor. The pump, a centrifugal pump driven by a diesel motor, operates at 105 - 110 pounds pressure. The rated capacity for this pump is 1,000 g.p.m. and is supposed to put in 1 acre-inch of water in approximately 1 hour. This unit is designed to irrigate 2.5 acres using a square pattern.

"Four runs were made of this system; two under daytime conditions and two at night. We have not been able to plot up our data but in general the readings indicate that we had a better distribution at night when the winds died down.

"The nozzle of this outfit is driven by a small turbine in the head of the nozzle. The wasted water from driving this turbine is used to irrigate the area immediately around the well. There is a secondary nozzle covering a radius of approximately 40 feet.

"It was noted that from where the water from the secondary nozzle ends to about three-fourths of the way out, there is a drop in the amount of water, that is, there seemed to be more water close in to the riser and at the end. We shall continue our checking of the irrigation system in the fall. This machine will have to be checked further.

"Moisture studies were continued during the month. We found that in plotting actual moistures against our wheatstone bridge readings at the saturation point that we had a very wide-spread on the graph. So we are trying a different method, that is, we are using a 1/4 inch sieve to separate the rock fragments from the soil material. So far we have found that the moisture holding capacity of the limestone is much less than the soil. Where there is no control of the amount of soil-rock taken into a sample, this will throw the moisture percentage off. We may have to use a finer screen to exclude more of the limestone, but I believe we are finally getting some place on our correlation.

"As will be noted from the following summary of our water table wells, the greatest increase occurs in wells in the northern and western part of the area. Rainfall was low for this period of the year. At Mowry Drive and Redland Road we had 9.12 inches of rain; and at the Sub-tropical Experiment Station, 7.48; so there was some fluctuation. Up to about a week ago the water table was falling at a very rapid rate.

Well No.	Water Table M.S.L. 6/4/46	Water Table M.S.L. 6/25/46	Increase in Water Table
1	3.11	3.46	.35
2	3.27	3.59	.32
3	3.35	3.57	.22
4	3.76	3.91	.15
5	3.98	4.06	.08
6	4.08	4.17	.09
7	4.70	4.85	.15
8	4.39	4.68	.29
9	4.47	5.03	.56
10	4.47	5.03	.56
11	4.44	5.41	.97
12	4.59	5.75	1.16
13	4.69	6.05	1.36
14	4.75	6.04	1.25
15	4.80	6.10	1.30
16	4.59	6.07	1.48
17	4.33	5.92	1.59
18	(This well bent over by bulldozer)		
19	4.28	5.64	1.36
20	9.98	11.39	1.41
21	4.44	5.54	1.10
22	4.98	5.72	.74
23	3.96	4.66	.70
24	4.29	4.91	.62
25	4.32	4.93	.61
26	4.90	4.99	.09
27	4.66	4.68	.02
28	4.51	4.52	.01
29	4.17	4.25	.08
30	3.74	3.91	.17
31	3.38	3.69	.31
G-28	4.36	5.81	1.55
E-32	2.99	3.50	.51
Meas.Pt.	4.48	6.03	1.55
E-33	2.65	3.08	.33

"Some work on tolerance in connection with the study of the intrusion of chlorides into the marl land, done in the green house by Mr. Borders, pathologist, indicates that velvet beans will not germinate or grow when the concentration is between 2,000 - 3,000 p.p.m. of chloride. Seeds will germinate and grow at concentrations of 1,000 p.p.m. but from this point on there is a very noticeable depression in growth."

Drainage Studies - R. E. Morris, North Liberty, Indiana.-"The average depths of water table in the various plots for the months of May and June are shown in the table below. The depths for June 21 are also shown and with them the depths of aeration in sweet corn as determined by the chemical test for ferrous and ferric iron. The latter test was made at three points in the sweet corn section of the drainage plots: (1) immediately over a tile line, (2) 12.5 feet from the tile line, and (3) 25 feet from the tile line. It can be readily seen that there is more correlation between the monthly averages of water table depths and the depth of aeration than there is between the latter and the water table depths on the day that the aeration tests were made.

Plot No.	Depth of Water Table			Depth of Aeration in Sweet Corn		
	May	June	June 21	1	2	3
	Inches	Inches	Inches	Inches	Inches	Inches
1	34	30	24	30	30	30
2	36	30	36	33	33	33
3	28	25	18	27	27	24
4	18	14	7	18	18	15
5	18	13	6	6	12	12
6	28	25	19	24	24	24
7	32	28	23	33	27	24
8	37	35	29	42	30	33

IRRIGATION DIVISION

California Crop Requirements.-The Division of Water Resources, California Department of Public Works, has completed the publication of its Bulletin No. 51, "Irrigation Requirements of California Crops," by Arthur A. Young, and copies are now available for distribution.

Evaporation from water surfaces.-A. A. Young obtained records of evaporation for the series of storage reservoirs operated by the San Diego Water Department at locations from a few hundred to 4,000 feet above sea level. Because of the influences of marine climate, which does not necessarily extend to higher elevations, evaporation from mountain reservoirs sometimes exceeds the losses from lower levels. Most of the water supply for this city of 350,000 population results from stream flow collected in a number of storage reservoirs which often maintain a carry-over supply for periods of 2 to 4 years. The total evaporation losses are thus an important part of the initial supply and must be estimated in all water inventories. Such estimates are based upon measurements from both floating and land-evaporation pans. Tabulations for the current evaporation report are receiving their preliminary typing and copies are to be sent the source agencies responsible for the records for examination and criticism. Such tabulations are now ready for the Los Angeles County Flood Control District and the Los Angeles Department of Water and Power, covering a total of approximately 40 pan records, most of which are continuous for periods of 10 to 15 years.

Texas seepage data.-Dean W. Bloodgood reports assembling, for mimeographing and limited distribution under one cover, various data on seepage losses from canals. This material comprises reports and previously unassembled data which have been accumulating in the files of the Texas cooperation for several years.

Canal-Lining Manual.-Carl Rohwer reports that the first draft of the canal-lining manual was completed except the summary and a discussion of the economics of canal lining. Seepage observations on the experimental linings were made in a lateral on the College East Farm at Fort Collins, Colo. These tests showed that the losses from the concrete linings were the same as last year, but the losses from the asphalt and the bentonite linings were considerably greater than they were a year ago. Inspection of the concrete lining showed that cracking had not increased during the winter and that the asphalt and the bentonite linings had not deteriorated appreciably. It was apparent, however, that the bentonite had stimulated weed growth. A few weeds were growing in the asphalt lining and none in the concrete lining.

Storage of Water Underground - San Joaquin Valley, Calif.-Dean C. Muckel inspected the test ponds at Minter Field and Wasco. After tabulating and plotting the daily percolation rates obtained during the previous month, a suggested program of operation was prepared to cover the next two months. The ponds had been operated and undergoing special treatment

in accordance with a program set up May 1. Continuance of these treatments and methods of operation depended upon the shape of the percolation curves. Some of the ponds have been undergoing drying periods and treatments to increase the organic matter in the soil. Starting times for spreading water on these ponds were suggested and a program for taking soil-moisture samples was outlined.

Soil-moisture data collected at the Wasco group of ponds were assembled and plotted against the percent of recovery in percolation rates as compared with the initial percolation rate. Although the points are somewhat scattered, there appears to be a relationship between the degree of drying and the percolation rates during subsequent runs. The taking of soil samples for moisture determinations during non-spreading periods has been carried on only during the past few months. Consequently sufficient data are not yet available for drawing definite conclusions. In order to carry out certain tests suggested by the results obtained from the Minter Field and Wasco group of ponds a proposal has been made to establish experimental spreading areas in the Madera Irrigation District where it is hoped to find a continuous flow of gravity water in the quantities required. The length of run at the existing Minter Field ponds is limited to a few months each year because of the shortage of water in Lerdo Canal. At Wasco the water supply for the experimental plots is pumped from a well and consequently the quantity is limited. The status of the suggested cooperation with the Madera Irrigation District was discussed with representatives of the North Kern Water Storage District and the Bureau of Reclamation.

Design, Invention and Testing of Apparatus.-R. L. Parshall reports that the 9-inch portable form for casting concrete Parshall measuring flumes was used on the Twin Lakes Reservoir & Canal Company system in building two structures, one operating under free-flow, the other under submerged-flow conditions. The form was found to be practical and the two structures cast were true to dimension and of good appearance. Because of the limited irrigation supply under this canal system, it is necessary that the diversion to each user be accurately measured in order that each may be served according to his rights in the common supply. It is the intention of this company to construct 50 or 60 of these flumes immediately and, because of the apparent success of the two structures built, it is probable that a large number eventually will be provided to distribute the water efficiently over the 56,000 acres of farm land under the system.

Mr. Parshall reports that the apparatus at the Fort Collins hydraulic laboratory intended for studying the possibility of creating a rolling or vortical flow in a semi-circular flume is ready for observation. This flume is 11 feet long; the semi-circular section is 8 inches in diameter with depth of vertical sidewalls totaling about 10 inches. This model is constructed on a scale ratio of 1 to 3.

Flow of Water in Ditches, Pipes, and Other Conduits.-Fred C. Scobey reports completion of computations and tabulation of pipe flow for his metal-pipe, concrete-pipe, and wood-stave pipe formulas, for Manning's formula (erroneously used for pipes) and for the Williams-Hazen formula. These computations, some 1,200 in number, covered 15 sizes of pipe from 3 inches to 30 feet in diameter. Low, medium, and high velocities were computed for each pipe and for each of many coefficients. Logarithmic paper, on 10-inch base, covering 4 decimal zones, was prepared. On this paper all the computations for the mentioned formulas can be platted as straight lines, the three points computed determining the slope and location of the line for each size of pipe, for specific coefficients. Selected sizes from 3 inches to 30 feet were platted. The results disclose the need for acceptance of a single formula if ideas of hydraulic engineers are to be reconciled. For basic analysis, results applicable to new pipe are first platted. For given losses of head (friction loss) the following deviations appear:

1. For 6-inch pipe, W-H at C = 150 and Scobey's metal at 0.26 give highest V, with Scobey's wood-stave and Manning's n = 0.010 about equal at lowest V. Scobey's concrete-pipe formula lies about midway between two groups.

2. For a 24-inch pipe W-H at 150 and Scobey's metal at 0.26 are still highest in velocity; Manning's n = 0.010 is about midway in the group and Scobey's wood-stave gives lowest V.

3. By the time a 60-inch pipe is considered, W-H and Manning cross each other and indicate the highest velocities; Scobey's metal pipe is about midway and his stave pipe is still the lowest in velocity.

4. For a 12-foot pipe, Scobey's metal pipe has dropped back almost to the velocity shown for stave pipe; W-H and Scobey's concrete cross each other somewhat slower than Manning.

5. By the time a 30-foot pipe is reached, Manning is far out of line. For a velocity of 10 feet per second, it would require a value of Williams-Hazen C = 166 to conform to Manning at n = 0.010. Mr. Hazen was skeptical of all values for his formula above C = 140. Mr. Scobey believed for many years that any tests indicating a value of C more than 155 are probably wrong and that no surface is smooth enough to yield a value above C = 160. There is a wood-stave pipe in eastern Canada 20 feet in diameter owned by a company that was about to build, in 1942, a stave pipe 30 feet in diameter. The concrete tunnels at Boulder Dam are, hydraulically, smooth pipes, 50-foot diameter, with velocities above 100 feet per second.

Mr. Scobey says that the zone of variation in velocities for same size pipes at same losses of head for formulas that are accepted by large groups of engineers, extends about 15 percent each way from a median line which converts to a variation of some 30 percent faster for the most optimistic formula over the most conservative.